



Project Introduction

This space technology research effort will develop photonic integrated circuit technology for deep space laser communications. Photonic integration is a method to integrate several photonic functions on a chip in a manner similar to integrating transistors in an electronic integrated circuit. Current space laser transmitters are assembled with discrete components, which is a cumbersome and costly process. Light is coupled to and from each component through fiber couplers, which introduce optical losses and potential failure points. Photonic integration eliminates these coupling elements by interconnecting components on chip while also significantly reducing the size, weight, and power of the laser transmitter. With this technology, entire laser transmitter systems can be realized on a single chip. The HELIOS project will evaluate the potential impact of applying photonic integration to deep space laser transmitters, and establish target specifications by working closely with flight transmitter experts at MIT Lincoln Laboratory and Jet Propulsion Laboratory. A library of high-performance photonic building blocks will then be developed. The vision is that system architects will eventually leverage this library to design integrated flight transmitters in a straightforward manner using circuit simulation and design tools. The library will contain fundamental building blocks such as lasers, optical modulators, and optical amplifiers, as well as blocks for performance monitoring including optical taps and photodetectors. Designers will be afforded the flexibility to configure devices for specific modulation formats, and customize laser designs for required output power levels. As such, HELIOS will innovate space exploration by providing a more compact, lower cost, more reliable, and higher performance solution for high data rate deep space laser communications.

Anticipated Benefits

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HELIOS: Heterogeneous Laser Transmitter Integration for Low SWaP

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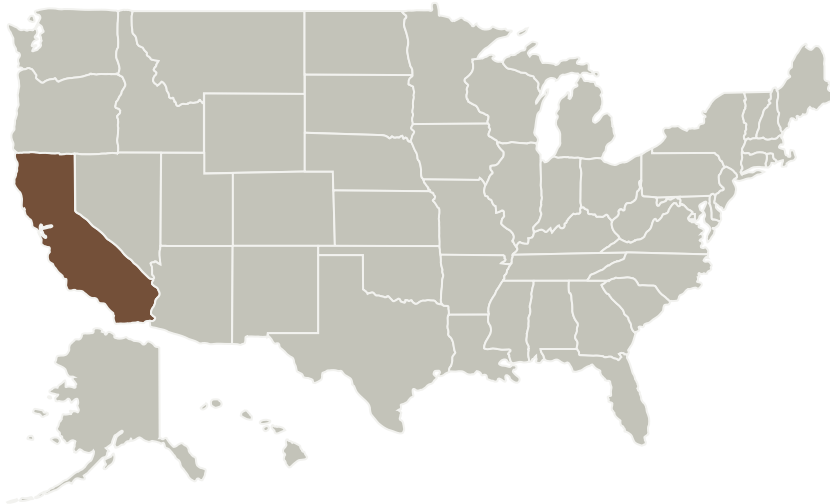
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HELIOS: Heterogeneous Laser Transmitter Integration for Low SWaP



Completed Technology Project (2014 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of California-Santa Barbara(UCSB)	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	Santa Barbara, California

Primary U.S. Work Locations

California

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of California-Santa Barbara (UCSB)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

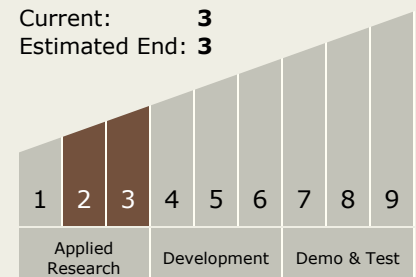
Hung D Nguyen

Principal Investigator:

Jonathan Klamkin

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3





Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.1 Optical Communications
 - └ TX05.1.3 Lasers

Target Destinations

Mars, Others Inside the Solar System